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Advances in Space Research 53 (2014) 674–688

ADVANCES IN SPACE RESEARCH (a COSPAR publication)

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Height-latitude structure of stationary planetary waves in the stratosphere and lower mesosphere

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Received 24 March 2013; received in revised form 27 October 2013; accepted 4 December 2013
Available online 19 December 2013

Abstract

Daily UK Met Office stratospheric assimilated data for the Northern and Southern Hemispheres, accumulated for the period from 2004 to 2012 and pressure range of 1000–0.1 hPa, are used in this paper. The paper presents and thoroughly discusses spatial–temporal distributions of stationary planetary wave (SPW) amplitudes and phases, calculated on the basis of geopotential height, temperature, zonal and meridional wind data for zonal wave numbers 1 and 2 (SPW1 and SPW2). The climatological planetary wave amplitudes and phases are calculated by extracting waves from three types of data: daily, monthly mean and climatological monthly mean. It has been established that magnitude of amplitudes and height-latitude distribution of amplitudes of SPW1 and SPW2 depend on data processing method for all parameters. It has also been established that height-latitude distribution amplitudes and phases significantly differ for geopotential height, temperature, zonal and meridional wind and depend on wave number and hemisphere. However, height-latitude distributions of phases are little different from each other for the used methods of data processing.

Keywords: Stationary planetary waves; Structure and dynamics of the stratosphere; Reference atmosphere

1. Introduction

So far, still recommended for use is the reference model CIRA 1986 (Barnett and Corney, 1985a, 1985b). It is the first model based on satellite data and is widely recognized by the world scientific community. At one time it has become a notable scientific event and was the qualitative improvement of the previous reference model CIRA 1972 (CIRA 1972).

Model CIRA 1986 consists of two parts. The first one (Barnett and Corney, 1985a) contains the zonal model, the second one (Barnett and Corney, 1985b) includes a model of non-migration planetary waves in the form of amplitudes and phases of temperature and geopotential altitude with zonal wave numbers $m = 1, 2$. These two models globally cover latitudes between 80 S and 80 N in the range from underlying surface to a height of 80 km. Model CIRA 1986 is based on instrumental satellite temperature observations made within the period of 1973–1978. Three-dimensional geopotential height field above the surface of 30 hPa was recovered by hydrostatic equation integration using temperature data. Bottom boundary of integration region (30 hPa) was determined by monthly averaged data. At the same time, the data period (1968–1972) for the Southern Hemisphere differed from the satellite data period (Knittel, 1974). Oort climate data (Oort, 1983) was used to provide data for the level under 30 hPa. Actually CIRA 1986 model contains data from different sources. Since that time satellite instruments of thermal atmosphere sounding have greatly improved. There is a great progress observed in processing of data obtained by synthesis of different observation platforms using the model of general troposphere and stratosphere circulation (Swinbank and O'Neill, 1994). Taking into account new high-quality long series, as well as the fact that more than

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http://dx.doi.org/10.1016/j.asr.2013.12.010